

# AGS Operations Cost

**RSVP Preliminary Baseline Review**

**April 6-8, 2005**

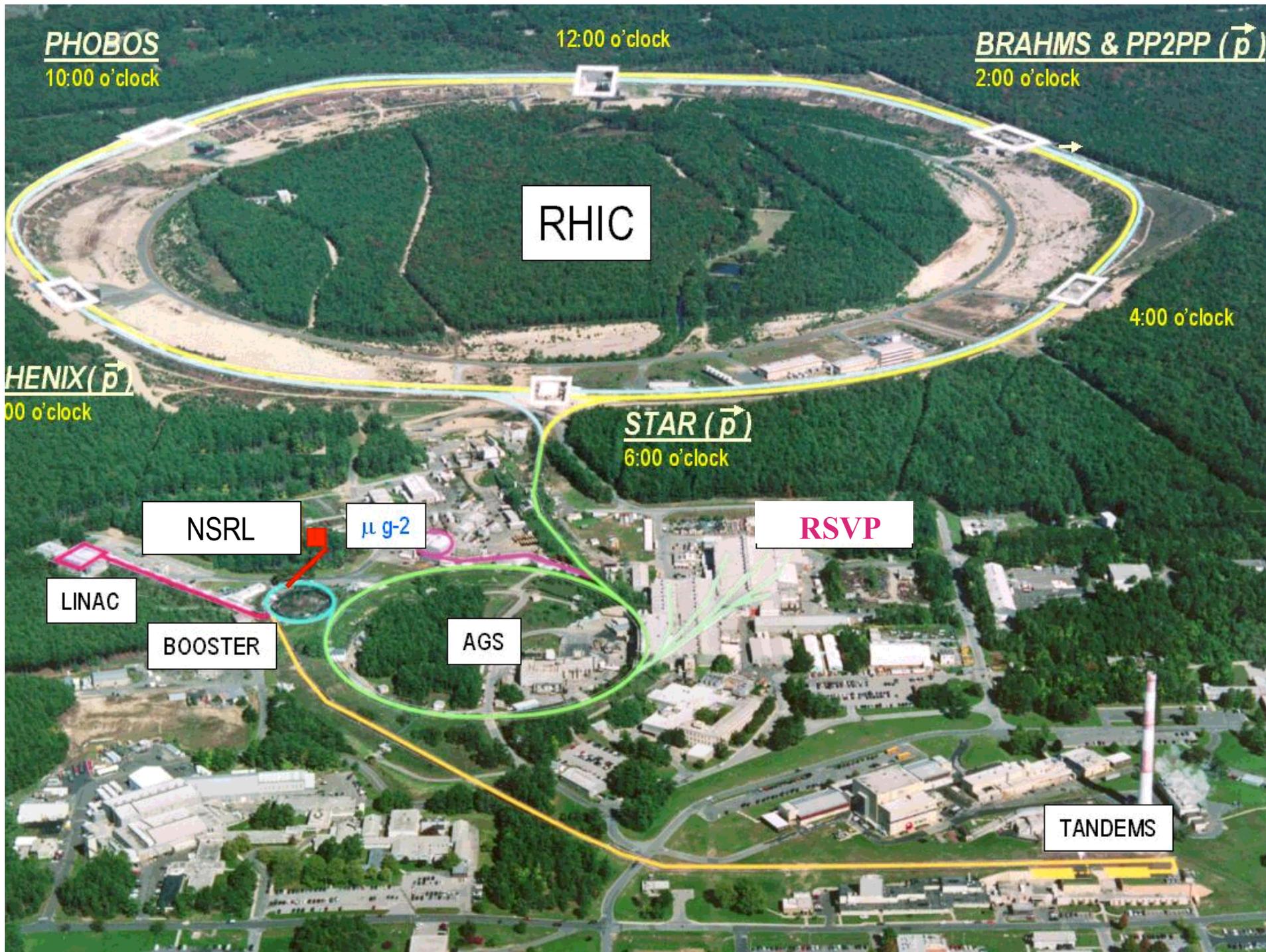
**Derek I. Lowenstein**



# Outline

---

- **Facility description**
- **RSVP operations cost**
  - **Projected cost**
  - **Historical data**



## 1. More operational flexibility than other hadron colliders

- **Variation in particle species, also asymmetric**  
→ So far Au+Au, d+Au, p+p, Cu+Cu
- **Variation in cm. energy**  
→ Au+Au at 20, 62, 132, 200 GeV  
→ Cu+Cu at 20, 62, 200 GeV
- → p↑+p ↑ at 200 GeV (500 GeV in the works)
- **Variation in lattice**  
→ Low  $\beta^*$  in most cases (.8-3 m)  
→ Large  $\beta^*$  for small angle scattering experiments (>10 m)  
→ Polarity change of experimental magnets

## 2. Four experiments (2 large, 2 small), different preferences

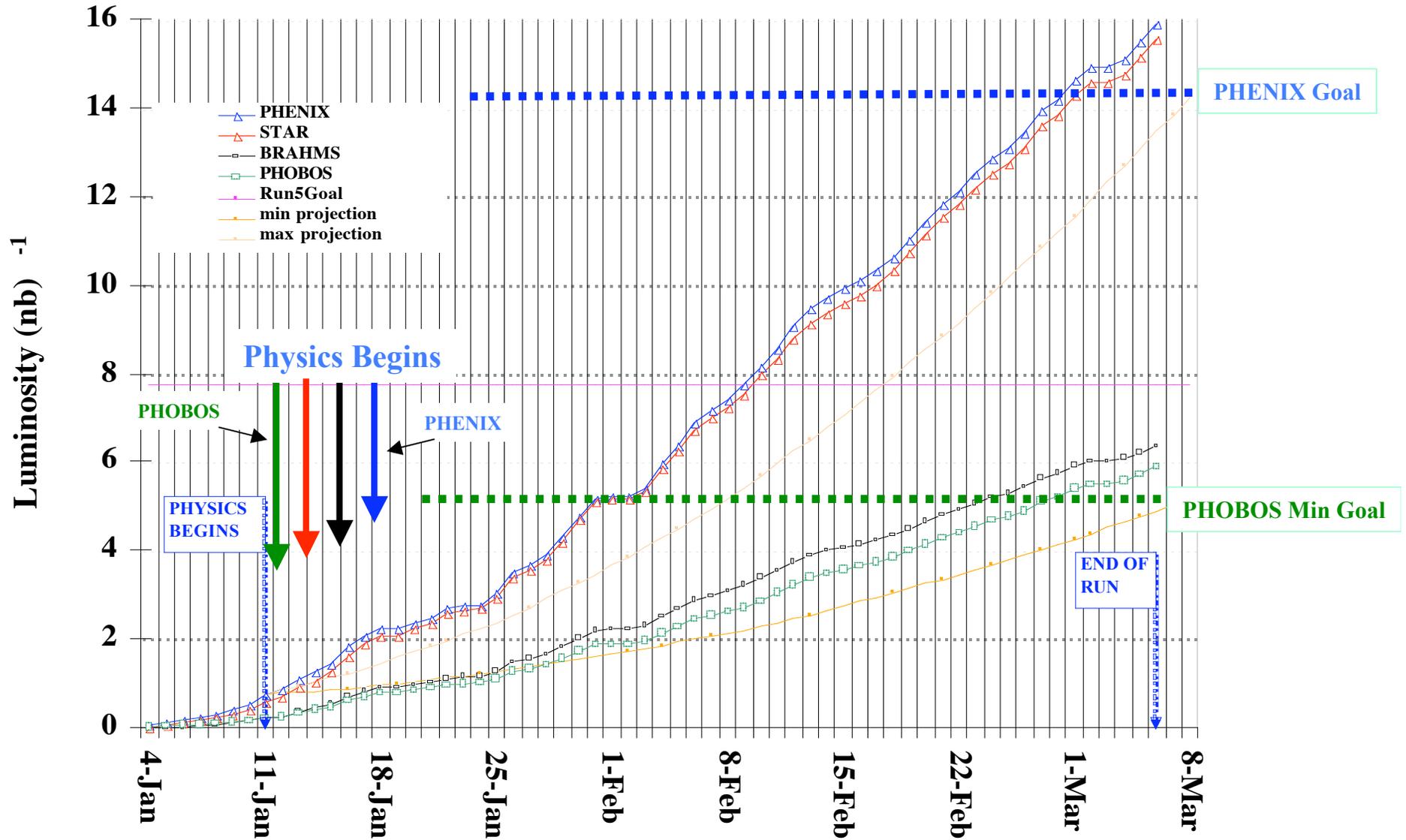
## 3. Short yearly runs (~30 weeks/year), with multiple modes

- **Significant amount of set-up time required for each new mode**

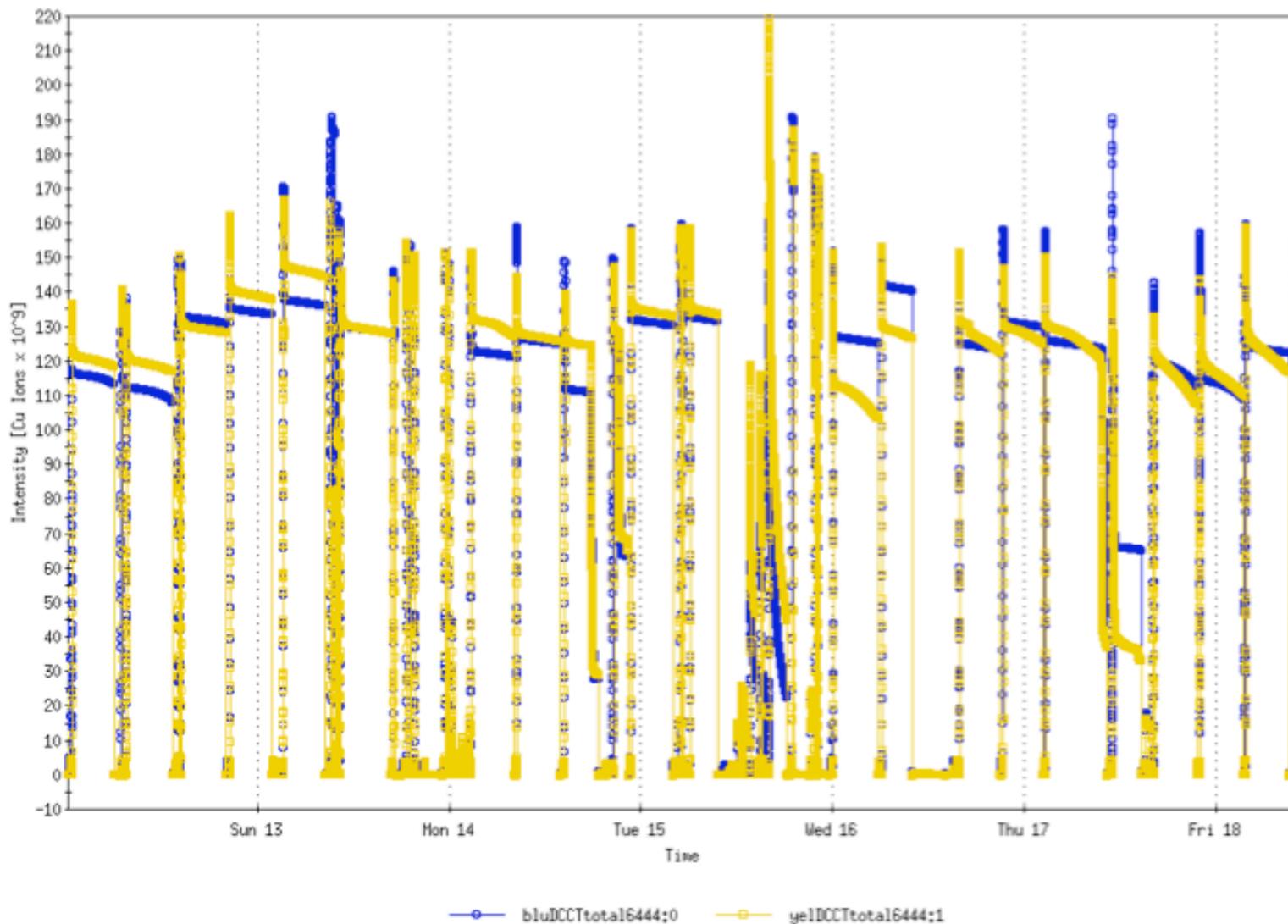
## 4. Short luminosity lifetime with heavy ions (1 to 4 hours)

- **Fast refills essential**

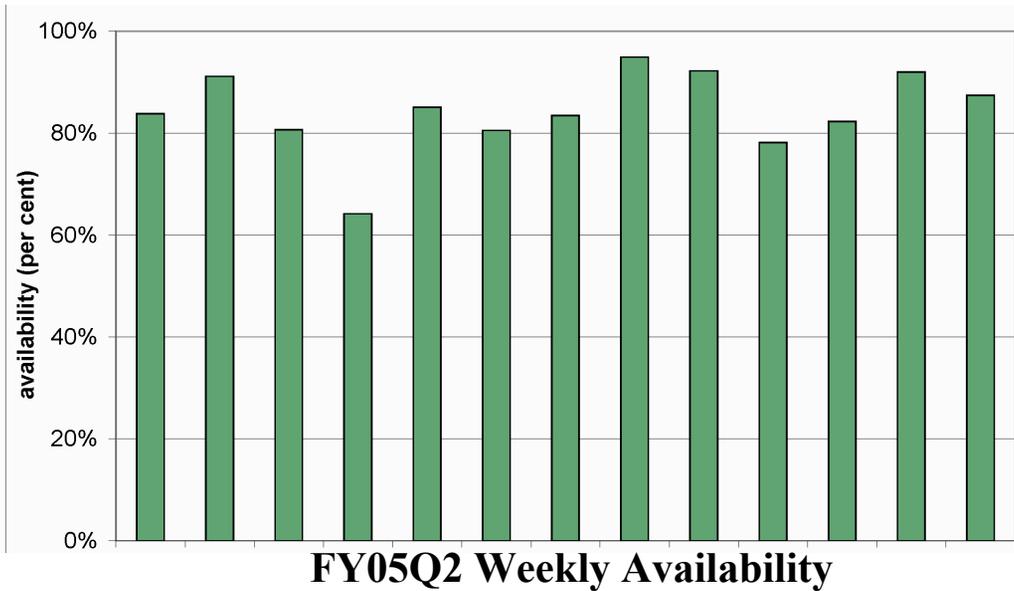
# RHIC Run 5 Final Delivered 100x100 GeV/n Cu-Cu Luminosity



## RHIC STORES AT COLLISION



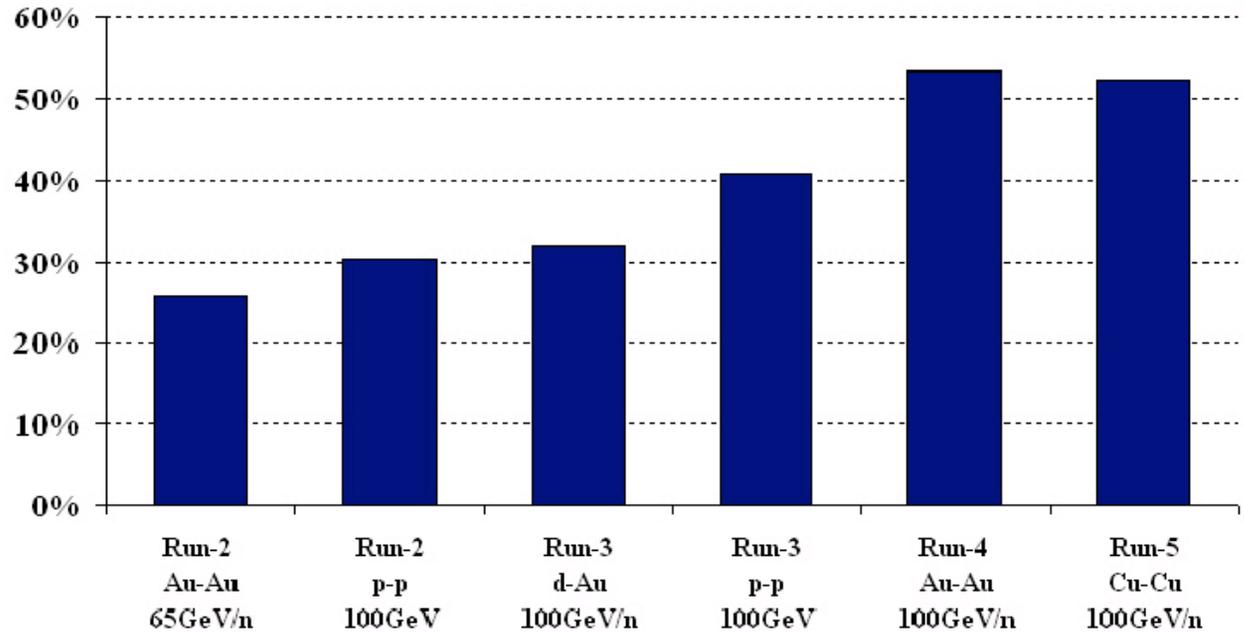
## RHIC availability and time in store



Excellent availability despite very complex operation modes.

Machine set-up time reduced to just 3 weeks.

RHIC time in store



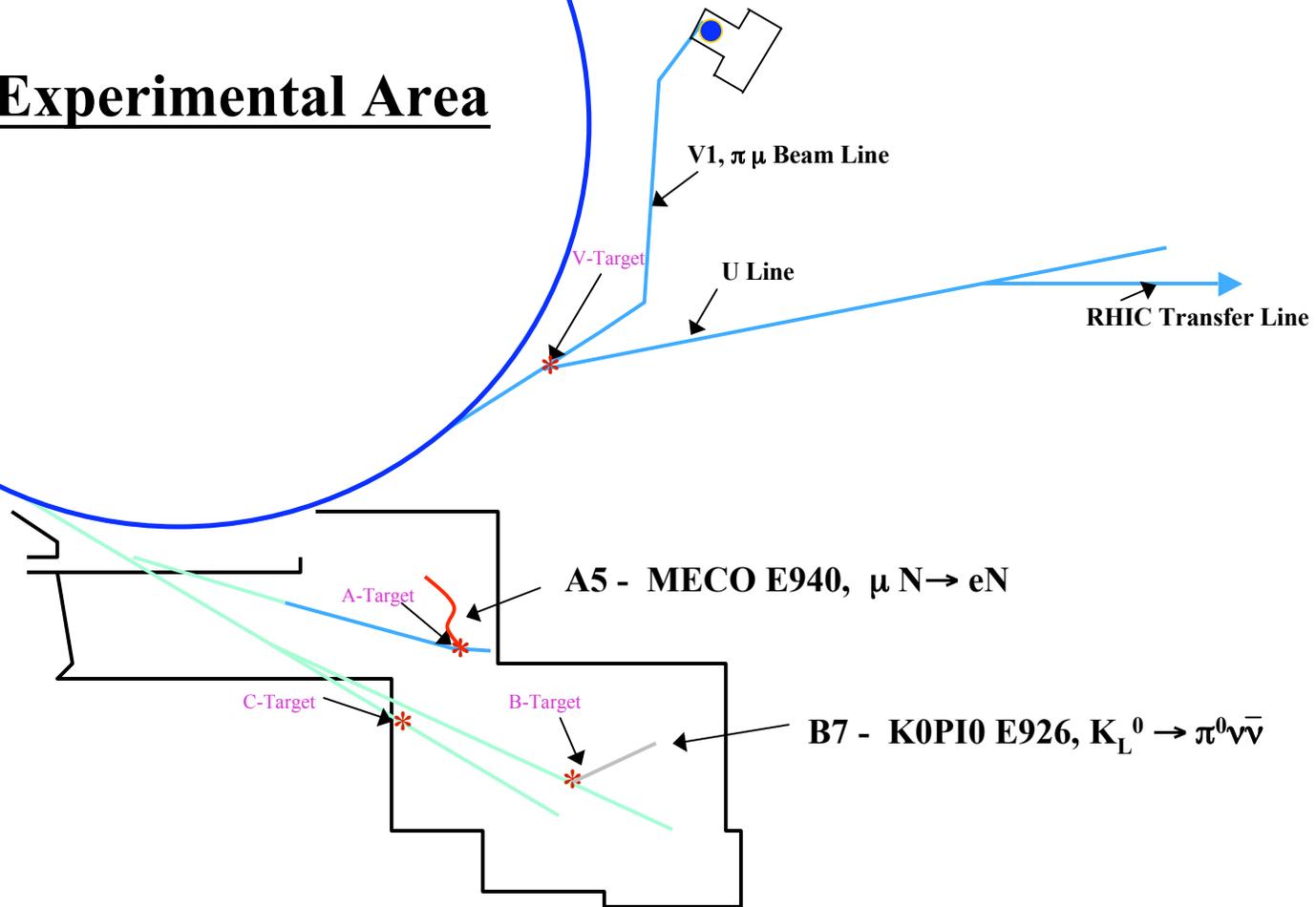
---

## NASA Space Radiation Laboratory

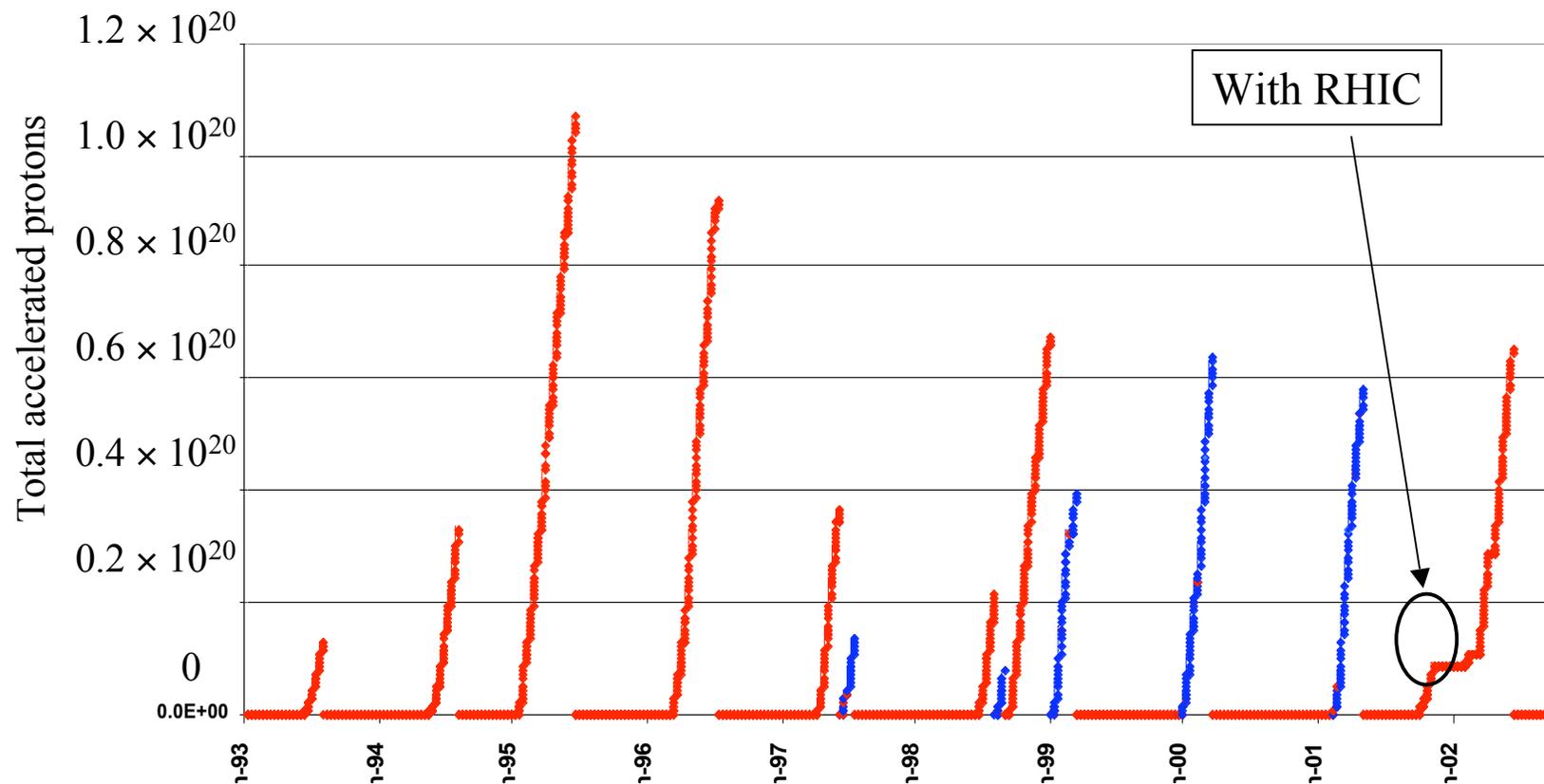
- Radiobiology and physics
- Protons to gold
- Slow extracted
- 40-3000 MeV / nucleon
- 3 sessions per year, 1000-1200 hours per year



# AGS Experimental Area



## AGS Total Accelerated Protons



— Slow extracted beam (Kaon decay)

— Fast extracted beam (g-2)

Note: Lower total accelerated protons in later years due to much shorter running time

## AGS Operations Costs

- **RSVP is costed on an incremental basis to the RHIC program.**
  - Additional manpower is matrixed into C-AD operations.
- **Previous fixed target operations costs are the basis for our estimates and modified by present realities.**
  - **During 1990s the base program was supported by DOE HEP.**
    - **During the same period a heavy ion fixed target program was supported by DOE NP.**
    - **Heavy ion and proton operations were incompatible and run as separate programs.**
- **Selected FY97 as a representative year.**
  - **Budgets are presented in both FY97\$ and FY05\$.**
- **Significant increases since 1997.**
  - **Electrical power**
  - **BNL Overhead = Allocations + Indirect expense**

## AGS Fixed Target Program Expense History

	<u>Base program</u>		<u>Incremental to HEP</u>	
	<u>HEP</u>		<u>NP*</u>	
	<u>FY97</u>	<u>Escalated</u>	<u>FY97</u>	<u>Escalated</u>
	<u>FY97\$</u>	<u>FY05\$</u>	<u>FY97\$</u>	<u>FY05\$</u>
S&P FTE	88	88	10	10
Other FTE	166	166	21	21
Total FTE	254	254	31	31
	<u>\$M</u>	<u>\$M</u>	<u>\$M</u>	<u>\$M</u>
Salary	20.6	27.1	2.3	3.2
Distributed Technical Services	1.1	2.7	0.4	0.6
Purchases	4.3	5.6	0.5	0.7
Electrical Power	4.6	8.7	3	4.6
Overheads	13.2	24.7	1.9	3.1
Total	43.8	68.8	8.1	12.2
Capital	1.2		0.5	
AIP	1.9		1.3	
Running weeks	15		12	
# AGS Beamlines	12		3	

\* Includes Tandem operations  
NP FY98, Transition to RHIC begun.

## **RHIC / RSVP Program Expense Budgets**

	<u>Base program</u>	<u>Incremental to NP</u>	<u>AGS Standalone No RHIC Facility</u>
	<u>NP</u>	<u>RSVP**</u>	<u>RSVP**</u>
	<u>FY05</u>	<u>FY05</u>	<u>FY05</u>
	<u>FY05\$</u>	<u>FY05\$</u>	<u>FY05\$</u>
S&P FTE	168	4	25
Other FTE	214	15	110
Total FTE	382	19	135
	<u>\$M</u>	<u>\$M</u>	<u>\$M</u>
Salary	40	2.1	14
Distributed Technical Services	3.5	0.4	1.5
Purchases	8.5	3.2	5.7
Power(MECO, KOPIO)average	9.6	3.9	7.8
<i>RSVP Cost @ \$85 / MWH</i>	14.8		
Waste Management	3	0.1	1.9
Overheads	37.6	3.4	17.0
3% Full Cost Recovery	0	0.4	1.4
Total	102.2	13.5	49.3
D&D			
Capital	1.5		0.5
AIP	3.1		1.1

## RSVP and RHIC Monthly Manpower Budget

RSVP Projected Equivalent Heads	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Average
Machine	5	6	6	6	6	6	6	6	6	3	4	5	5.4
Controls	0.5	0.5	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	0.5	0.3
Beams	6	6	5	5	5	5	5	5	5	3	3	6	4.9
Utilities	2	2	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5	1	0.6
Access Con.	0.5	0.25	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0	0.25	0.1
Expt 1	6	6	6	3	3	3	2	2	2	1	0	2	3.0
Expt 2	3	3	3	6	6	6	3	3	3	1	0	2	3.3
Cryo	0.5	0.5	0.5	2	2	2	1	1	1	0.5	0.5	0.5	1.0
FTE Total	23.5	24.25	21.1	22.6	22.6	22.6	17.6	17.6	17.6	9	8.5	17.25	18.7

RHIC cooldown starts Nov. 1  
 AGS SEB turn on Dec 15  
 Expt. 1 (KOPIO) Startup Jan 1, Expt 2 (MECO) startup Apr 1  
 Expt. Ends June 30  
 2 experiment s / year runs

Machine includes: linac, extraction equipt., ion source, RFQ  
 Beams include switchyard, proton transport, vacuum, instrumentatiuon  
 Utilities includes; power, water, towers, HVAC  
 Safety, training are include in org. burden

RHIC FY 2004 Equivalent Heads	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Average
Accelerator Div.	274.6	265.8	253.2	221	229.6	219.6	224.4	227.8	230.9	218.7	220	227	234.4
Experiments & Facilities Div.	57	64.7	63.5	55.4	56.3	57.4	54.9	53.3	55	55.7	54	53.4	56.7
Controls Group	33.8	33.4	31.3	30.1	29.3	31	30.7	33.1	31.6	29.7	30.2	27.8	31
Superconducting Magnet Div.	25.7	35.5	37.2	31.2	39.2	40	35.1	35.6	35.6	17.1	6.2	3.4	28.5
Waste Management	2.9	1.8	1	1.8	0.9	0.9	1.4	0.9	0.9	1.2	0.8	0.8	1.3
ES&H Group	9.8	9.1	8.9	9.4	9.6	10.4	9.7	9.5	8.9	8.3	8.6	7.7	9.2
Administrative, Chairs office	25.9	20.9	19.6	20.1	20.4	21.5	20.4	20.8	20.2	18.3	18	19.1	20.4
FTE Total	429.7	431.2	414.7	369	385.3	380.8	376.6	381	383.1	349	337.8	339.2	381.5
NSRL	14.3	8.9	13.6	12	14	17	10.9	11.8	16.8	10.1	10.2	13.3	12.7
C-AD Total	444	440.1	428.3	381	399.3	397.8	387.5	392.8	399.9	359.1	348	352.5	394.2

---

## Historical Budget Material

D.I. Lowenstein

4/1/05

**COLLIDER-ACCELERATOR DEPARTMENT**

Circa April 2005

**Mission:** "To develop, improve and operate the suite of particle/heavy ion accelerators used to carry out the program of accelerator-based experiments at BNL; support of the experimental program including design, construction and operation of the beam transports to the experiments, plus support of detector and research needs of the experiments; to design and construct new accelerator facilities in support of the BNL and national missions. The C-A Department supports an international user community of over 1500 scientists. The Department performs all these functions in an environmentally responsible and safe manner under a rigorous conduct of operations approach."

**Staff:** The Collider-Accelerator Department headcount is:

	<u>Total</u>	<u>NP*</u>	<u>SNS</u>	<u>NASA</u>	<u>Other</u>
Ph.D. Scientists	49	45	0	2	2
Postdoctoral Fellows	3	3	0	0	0
Engineers/Professional	131	121	1	5	4
Designers/Technicians	181	171	0	5	5
Admin./Clerical	<u>20</u>	<u>20</u>	<u>0</u>	<u>0</u>	<u>0</u>
Totals	384	360	1	12	11

\*Does not include ~33 Magnet Division employees charged to NP  
Additional support ~13 FTEs are purchased as Laboratory assigned trades.

**Facilities:** Principal facilities of the Collider-Accelerator Department comprise

- 640,000 ft.<sup>2</sup> accelerator areas
- 140,000 ft.<sup>2</sup> experimental areas
- 173,000 ft.<sup>2</sup> general office/laboratory space
- 149,000 ft.<sup>2</sup> high-bay work space
- 87,000 ft.<sup>2</sup> storage/materials handling space
- Research Library and 190 seat auditorium

**Funding:** Estimated DOE Funding (initial new B/A) for FY 2005 (\$M to date) comprises

<u>Fund Type</u>	<u>DOE NP</u>	<u>SNS</u>	<u>NSRL</u>	<u>Other</u>	<u>Totals</u>
Operating	102.2	0.0	5.1	3.0	110.3
Equipment	1.5	0.0	0.0	0.0	1.5
Construction/AIP	<u>3.1</u>	<u>5.4</u>	<u>0.0</u>	<u>0.0</u>	<u>8.5</u>
Totals	106.8	5.4	5.1	3.0	120.3



AGS WEEKS

